

## ABSTRACT

Methods and apparatus for separating ions of metallic elements are provided. Preferred methods utilize a hydrophobic chelating extractant, such as an organophosphorus compound, adsorbed onto carbon or graphite fibers in the form of felt. Also described is a new thallium-201 generator that comprises a column containing an acidic organophosphorus extractant adsorbed on carbon or graphite fibers, and a yttrium-90 generator system comprised of two extraction columns designed to selectively absorb yttrium-90 at different pH, to enable the separation of yttrium-90 from strontium-90. The two columns are connected in series for stepwise separation. The yttrium-90 product is freed from residual strontium-90 and metal contaminants and can be eluted from the second column with dilute acid, acetate buffer, water or saline for labeling biological targeted molecules. The new generator system provides rapid and efficient separation of yttrium-90 and is amenable to both scale-up and automation. Also described is a new  $^{99m}\text{Tc}$  generator that comprises a column containing an acidic organophosphorus extractant adsorbed on carbon or graphite fibers designed to selectively absorb  $^{99}\text{Mo}$  at a selected pH, to enable the separation of  $^{99m}\text{Tc}$  from  $^{99}\text{Mo}$ .